

# SOME LICE OF DOMESTIC ANIMALS



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SOME LICE OF DOMESTIC ANIMALS



The larger fleas have little fleas  
Upon their backs to bite 'em,  
These little fleas, still smaller fleas,  
And so on ~ ad finitum.



- C O N T E N T S -

	Page
Chapter I. Introduction.....	1
Origin and parasitic habit (p.1) - Distribution of parasites (p.3) - General classification (p.4) - Siphunculata - characteristics (p.4) - General Life History (p.5) Mallophaga - characteristics (P.6) - Damage done (p.8).	
Chapter II. The Lice of Cattle.....	10
How cattle become infested (p.10) - The regions infested (p.12) - The Injury from Cattle Lice - (p.12) - Time of Infestation (p.13) - The Short- nosed Cattle Louse - History (p.14) - Description (p.15) - Life History (p.16) - The Long-nosed Cattle Louse - History (p.16) Description (p.17) - Life History (p.17) -The Little Red Cattle Louse - History (p.18) Description (p.18) - Life History (p.19) - Control (p.19).	
Chapter III. The Lice of Horses.....	21
The causes of infestation (p.21) - The regions infested (p.22) - The injury from horse lice (p.23) - The time of infestation (p.23) <i>Haematopinus</i> <i>asini</i> - History (p.24) - <i>Trichodectes pilosis</i> - History (p.25) - Description (p.27) - <i>Trichodectes</i> <i>parumpilosus</i> - History (p.27.) - Description (p.28) - Life History (p.28) - Control (p.29).	
Chapter IV. The Hog Louse.....	31
<i>Haematopinus suis</i> - History (p.31) - The damage done from hog lice (p.32) - The regions infested (p.33) Description (p.34) - Life History (p.35) Duration of Life (p.38) - Control (p.38).	
Chapter V. The Lice of Poultry .....	40
Bird Lice (p.40) - Injury to poultry (p.41) - The Large Body Louse - History (p.42) - Description (p.43) - Life History and Habits (p.43) The Small Body Louse - History (p.44) - Description (p.45) Life History and Habits (p.45) - The Head Louse - History (p.45) - Description (p.46) - Life History and Habits (p.46) - Other Less Important Lice (p.47) - Control (p.48).	
Bibliography.....	50.



## CHAPTER I.

### Introduction.

In this dissertation on the lice of domestic animals, it is the aim of the writer to gather such information, mostly by the compilation of the work of others, and partly through research and experimentation, so that together, they will form an interesting treatise on these parasites affecting our domestic animals.

### Origin of Parasitic Habit.

Interesting, indeed, is the trend of evolution of these parasites. From a biological standpoint, it may be said that all parasites have sprung from non-parasitic forms. Since all lice are confined primarily to a certain definite host, it is obvious, then, that these parasites could not have existed as parasites before the occurrence of the host. It is possible that the ancestors of the lice were first attracted to the waste food, epidermal debris, and exudations of certain animals. The search of food having become simplified, they began living as messmates, or scavengers, until the associations between the two species became closer and closer, and eventually the line of parasitism became completed. This is borne out by a study of the nearest allies of a given parasite, in which the gradations from the free-living animal to the parasite may be traced. The



very close structural similarity between the free-living, wingless book-louse, *Troctes divinatoria* Mull, (a member of the order Carrodentia, family Psocidae), and a common hen louse, *Menopon biseriatum* Liaget, (a member of the order Mallophaga,) leads one to believe that the parasitic Mallophaga have been derived directly from the Psocidae. Knowing the habits of the book-louse, it is easy to imagine how the line of parasitism might eventually become established; ie. from the eating of skin, feathers and excretions off the animal to the eating of the same on the animal.

Degrees of parasitism may also be illustrated by examples from the biting lice, Mallophaga, in which there are species having the power to run freely and live for a considerable length of time off the host, as the common hen louse (*Menopon pallidum*), while other species have become quite sessile, as in the extreme case of the worm-like louse (*Menopontitan*), inhabiting the gular pouch of the pelican.

The natural tendency of an animal, once started in the direction of parasitism, will be to become more and more parasitic in habit, and it will thus show a greater and greater specialization of parts with reference to this habit. As a parasite becomes more and more permanent, certain organs become discarded, as for example, the organs of flight. Hence we find that all lice are wingless. The feet become adapted especially for locomotion among hairs and feathers of the hosts.



Today, the degradations of lice have become so great that they are absolutely dependent upon certain hosts and the presence of certain conditions for their existence.

Modifications have taken place, not only in the organs and systems, but in other ways, as the flattening of the bodies to facilitate movement among the feathers and hairs of the host. Changes are always taking place in various ways, affecting various structural conditions, but in all, the ultimate effect is the same, the adaptation to special conditions.

In other cases it may be barely possible that certain mutations have sprung up. These mutations sometimes breeding true, will have progeny so much better adapted for their environment that their numbers, increasing so rapidly, have crowded out their less fortunate brothers.

#### Distribution of Parasites.

All species of our animals are subject to one or more forms of parasites. All mammals, with the possible exception of the skunk, harbor one or more species of lice, while each louse has its special host.

The Pediculidae (sucking lice) are all confined to the mammals, while the Mallophaga (biting lice) are, for the most part, confined to the birds, although a few inhabit the mammals.



Of the Mallophaga only two genera, the Trichodectes and the Gyropus, are known to infest mammals. The Trichodectes occur on Carnivora, Ungulata, and Rodentia, while Gyropus is confined to the guinea pig. The genera confined to the birds, have a quite varied distribution among the different groups, the same genus frequently having representatives in widely different families of birds, while any one species of bird may harbor a number of species in several different genera. Moreover, each species of Mallophaga favors some particular region of its host, certain species occurring on the wings, others on the breast, and others on the neck and head.

#### General Classification.

For a simple classification, the lice may be divided into two groups, the sucking and the biting lice. Modern parasitologists have now placed these into two distinct and separate orders, the sucking lice belonging to the order Siphunculata, and the biting lice are placed in the order Mallophaga. Both orders belong to the class Insecta.

#### Siphunculata or The Sucking Lice.

The earlier writers have sometimes placed the sucking lice in the sub-order Parasita, order Hemiptera, or true bugs, but now the concensus of opinion places them in a separate order called Siphunculata. The lice of this order have the suectorial mouth parts at the anterior border of the head, the movable proboscis being formed of the upper and lower lips. Within this is the sucking tube which is projected beyond its sheath and buried in the skin when used to



suck blood. The eyes are two simple ocelli; one on each side. The antennae are short, being five jointed. The thorax is usually broader, but shorter than the head, with very indistinct divisions into segments. The legs are short and thick, the tarsi terminating with a single sharp pointed claw, well adapted to hold the parasite firmly on the host. There are no wings. The abdomen is large and fairly compressed and elliptical in outline. The last abdominal segment is rounded in the male with an opening for the penis. In the female this segment is notched and has two small terminal appendages. The females range from 1.5 mm. to 5 mm. in length, and the males somewhat smaller.

#### General Life History.

The metamorphosis is direct, or incomplete. The young which leave the eggs or nits by an operculum, have the shape of the adults, but do not acquire the adult color and size until after several molts.

The eggs as they are extruded from the female are glued fast to the hairs of the host by means of a viscid secretion. In this position they are commonly termed nits and with the aid of a hand glass they will be seen to be barrel-shaped, the more pointed end attached, the blunt end free. At the blunt end there is an easily distinguishable cap or lid which opens, upon maturity, to allow the young nymph to escape.

In general, hatching occurs from five to eight days, but in some species, as the hog louse, the incubation may take twenty-three days. The young greatly re-



semble the parents excepting in size. They become mature in about three or four weeks.

The sucking lice come into one family, the Pediculidae. All are permanent parasites, the entire life cycle being spent upon the host. All are limited to one host and will only accidentally inhabit a host of different species. Therefore, if the host is known, the identification is readily determined.

#### Mallophaga or Biting Lice.

The members of this order resemble the sucking lice in general form, but differ from them mainly in that they are much smaller and have the mouth parts adapted for biting and mastication. For the most part, they infect birds, hence they are generally known as bird lice. A few infest mammals. They may be at once distinguished by the head and mouth parts; the head is usually rounded, triangular, squared or crescent shaped, and is broader than the thorax.

Upon the under side of the head, are located the mandibulate mouth parts adapted for cutting and feeding upon epidermic scales, hairs, feathers and other cutaneous products. Under the microscope they may be seen as conspicuous black-tipped objects.

The eyes are simple ocelli located back of the short antennae and are often indistinct. The thorax is generally narrow, the prothorax being distinct, the two posterior segments fused. The legs are adapted for either running or clasping; in the first case the tarsi



are long and terminate in two claws (*Liotheidae*); in the second case the tarsi terminate in a single claw (*Philopteridae*). The wings are absent. The abdomen is generally elliptical; it may be elongated, or short and broad, approaching a globular outline. Their relative small size and hard, flattened bodies facilitate their movements among the hairs close to the body.

In their breeding habits, and life history, the Mallophaga agree with the Siphunculata. Although the Mallophaga have been variously subdivided, it will be sufficient to place the biting lice according to their hosts in the two families *Liotheidae* and *Philopteridae*. The former include only the bird lice, while the latter the biting lice of mammals and birds.

Biting lice, like the suctorial, are limited to a specific host, which, as a rule, they do not voluntarily leave, unless it is to crawl upon a host of the same species, in which case the migration is ordinarily accomplished when the bodies of the host animals are in contact. Often they may spread from one host to another by the changing of harnesses, or having fallen upon the stable floor, they may crawl to another host. There are many other conceivable means by which lice may spread, but the chief point is that they are permanent parasites and dependent upon their host so that they must either find another host within a limited time, or perish. Lice



of either order will seldom live more than a day upon an animal not its specific host, except in closely related species.

Damage Done.

Whether the degree of discomfiture and injury to an animal, due to the presence of lice upon its body, is slight or serious in its consequences, will depend upon the number and the group to which they belong. The sucking lice, piercing the skin and feeding upon the blood, cause a much more intense itching than that occasioned by biting lice, which in their habit of feeding upon surface epidermal products and dobris, have more the nature of scavengers.

The trouble caused by biting lice is largely that of irritation due to the crawling about and gnawing habits of the parasites. This irritation causes the host to become restless, thereby affecting its feeding habits and proper digestion, producing weakness and susceptibility to disease.

The presence of the lice as well as their location, is indicated by their eggs or nits upon the hair and the debris of their molts. Oftentimes, when either biting or sucking lice are present, the animals will frequently rub bare places at the region infected.

Lousiness is usually accompanied by an unthrifty condition, not necessarily resulting from the attack, but preceding it, as the reducing functional activity of the skin to such a condition as to affording an inviting



habitat for the parasites. As a rule, it might be said that the drier the skin, the more adaptable for lice, or the more oily it is, the less inviting it is. During the summer when the animals are on succulent feed, the secretions of the skin are greatest, consequently the infestation is at a minimum. When kept for a prolonged period upon dry feed, as during the winter months, they are most likely to be infested. It is mostly due to the lack of natural oiliness that we find some animals are more lousy than others. Just keeping the stables well cleaned, ventilated and lighted will not reduce the numbers of the lice, but the condition of the animals plays an important part.



## CHAPTER II.

### The Lice of Cattle.

Three important species of lice are found to infest our Beef and Dairy cattle. Of these, two have sucking mouth parts belonging to the family Pediculidae genus *Haematopinus*. The other having biting mouth parts, belongs to the family Philopteridae genus *Trichoclectus*.

All of these species are fairly common, and occur wherever cattle are found. *Haematopinus erysterinus* infests particularly the neck and shoulders, and these parts are frequently worn bare by the efforts of the animal to rid itself of the irritation caused by these unwelcome visitors. Mature cattle are more generally affected with this species than are calves. *Haematopinus vituli* are found mostly on calves, although not infrequently, they occur on mature stock. *Trichodectes scalaris* are perhaps the most common lice found on cattle, notwithstanding the fact that the biting group are most commonly found on birds and are better known as "bird lice".

### How Cattle Become Infested.

The common idea among cattle raisers many centuries ago was that lice have sprung from the debris, filth and manure generally prevalent about the barns. This theory, of course, has long been exploded, since it has definitely been proven that life cannot spring from anything but life.



The place where stock is kept, has a part in the degree of infestation, for in barns where cattle are overcrowded, the lice can more readily crawl from one cow to another. In stables that are well lighted, ventilated, clean and not overcrowded, the danger of infestation is lessened, since it must be remembered that lice cannot live for any considerable length of time away from the host.

While the condition of the stables and bedding is somewhat important, the essential factor which will determine the degree of infestation is the condition of the cattle themselves, especially the degree of dryness of the skin, since there is a close correlation between the secretions of the skin and the number of lice present. In other words, the drier the skin, the more inviting for lice and the better the lice can multiply. The fact that the lack of oiliness of the skin tends toward lousiness indicates a logical control measure for these parasites. This explains why cattle are apt to be more lousy in the winter when they have not very much succulent food. In summer they are out on pasture and succulent food is available at all times. Also, the variations in the numbers of lice on cows varies with the breed, the Holsteins being among the most infested, the Ayrshires and Guernseys being intermediate, while the Jerseys are not so badly infested. Calves which have not so oily a skin as mature stock, are more generally infested with lice.



The height of infestation is reached in the winter, probably during the months of January, February and March. At this time the skin secretions are at a minimum, thus giving the lice an optimum habitat. Again, certain cows will be infested early in the fall, and continue late into the spring, and it is very doubtful whether cows are at any time totally rid of lice. Upon very careful inspection, one may find lice on almost any cow at any time of the year.

#### The Regions Infested.

Cattle lice are by no means uniformly distributed over the cow, particularly if they are of the sucking species. The upper portions of the neck, shoulder tops or withers, escutcheon and switch of the tail are usually the parts that are infested with the largest numbers.

The forehead, portions between the horns, and the throat are places where the lice are next most likely to be found.

It is at the above mentioned places that people raising cattle should look for lice. This should be done after the cows have been in the stalls but a short time, and under no condition should one wait until the severe symptoms are present. While the biting lice move about somewhat, the sucking lice do not wander, but usually stay in one place the greater part of the time before reaching maturity, feeding continually.

#### The Injury From Cattle Lice.

That a cow is lousy does not necessarily involve



it in death, nor even cause it great inconvenience. The presence of a few lice on a cow may not affect that animal in the least, but a multiplication of these parasites will cause great inconvenience, and indirectly even, death. Thus the effect of lice on the host is dependent largely upon the numbers present.

The trouble caused by lice is largely that of irritation and the gnawing habits of the parasites. With the sucking lice it is not only irritation, but also the loss of blood which these creatures are continually sapping from the host. Animals which are very lousy become restless, thereby affecting their feeding habits and proper digestion, producing weakness and susceptibility to disease. One can easily imagine the bad effects, when thousands of sucking lice are present, each piercing the host with its needle-like mouth parts and demanding toll in a certain amount of blood. That calves in a lousy condition put on growth and weight but slowly is obvious. Just what loss of milk is due to lice is unknown, but it has been noted that the milk record declines with the increasing numbers of lice. Little proof is needed to show the dairyman that time spent in trying to control lice, will, in the end, be refunded with better stock and a larger milkpail.

#### Time of Infestation.

Lice are probably ever present on mature cattle the year round, although in the summer when the cows are on pasture, getting exercise and keeping in good condition,



the lice are at a minimum, and very hard to find even after a most careful examination. This is obvious for in the summer the secretions of the skin reach the highest point, and immunity to lice is the result, if it may be so termed. In the fall, the cattle are brought in from pasture and lice are seldom seen. Indeed, in most cases it is not until January or February that the dairyman realizes that his cows are lousy, and something must be done. This is the time of the year when the parasites show themselves in the largest numbers and also the time when they are hardest to control. If control measures were used within a week or so after the cows were brought in for the fall and winter, and repeated according to a definite schedule, the lice would never become very numerous, nor their control difficult.

1. Sucking Lice

THE SHORT-NOSED CATTLE LOUSE.

(*Haematopinus eurysternus*, Nitzsch)

Siphunculata

Pecticulidae

History:

This is probably the species that has been familiar from early time as the louse infesting cattle, though since this species and the following one have been greatly confused, it is impossible to say which has been most common. It was first accurately described by Nitzsch under the name of *Pediculus eurysternus* in 1818, and has received mention in every important treatise on parasites



since that date, as well as innumerable notices under the head of animal parasites, cattle lice, etc.

Description:

This louse is the largest of the species of lice found on cattle, and is common on oxen and other mature cattle, and sometimes found on calves. The full-grown female is about one-eighth to one-fifth of an inch in length and about half as broad, while the male is a little smaller and proportionately a little narrower. Aside from the difference in size, the female has two little brush-like organs on the next to the last segment of the abdomen.

The head is relatively short, and broad, rounded in front. At the front of the head may be seen the small rostrum or beak, the end of which is usually at or near the surface, but which is capable of extension and contraction.

The thorax is wider than long and widest at the posterior margin, where it joins the abdomen. The legs project from the side, are long and stout, the tarsus terminating in a single hook-like claw, especially adapted to clasping and clinging to the hair.

The abdomen differs greatly in form and size according to the degree of distention and the amount of material contained therein. As a rule, it may be called flask-shaped, and more or less flattened. There is a row of horny tubercles along each side and a row of chitinous plates along each side of the upper surface of the abdomen.



The general color is slatey with darker head and thorax.

(Plate II)

Life History:

The eggs or nits are white and can be distinctly seen glued tightly to the hairs along the shoulders. From thirty-five to fifty eggs are laid by the mature female and these are laid a few each day. The egg laying may extend over a period of from ten to fifteen days. These eggs hatch in from seven to eight days and the young lice commence drawing the cow's blood near the point from which they were hatched. The rate of growth depends somewhat upon the blood supply in the portion of the skin where they work. They mature in from fifteen to eighteen days when the females in turn lay eggs.

The Long-Nosed Cattle Louse

(*Hannatopinus vituli*, Linn.)

Siphunculata

Pediculidae

History:

In connection with the preceding species, this louse has long been familiar to cattlemen, although from an entomological standpoint, its history is not very clear. It seems to have been first technically described by Linnaeus under the name of *Pediculus vituli*, which name has been followed for the most part by many naturalists, with the exception of the change in the generic name by most of the English and American authors.



Description:

In this species, the body is about one-eighth of an inch long and not more than one-third of that in width. It is more common on calves, though it occurs frequently on older stock.

The head is long and slender, having the appearance of a point. When seen on the cattle it seems to be literally standing on its head, with mouth parts buried in the skin feeding on the blood of the animal it infests.

The thorax is longer than wide, and has a distinctly visible spiracle above the second pair of legs.

The abdomen is elongate, without chitinous plates and devoid of any tubercles along the sides. The terminal segment is set with numerous rather long hairs.

The louse is distinguished rather easily from the preceding species by being darker in color, more slender and by its pointed head. (Plate III)

\*Life History:

The eggs of this louse are dark, nearly black and hatch in from eight to nine days. Like the previously mentioned species, these lice move about but little before maturity but continue feeding near the point where they were hatched. They in turn lay eggs in fifteen to eighteen days.

2. Biting Lice

The Little Red Cattle Louse.

(*Trichodectes scalaris*, Nitzsch)



History:

This species appears to have been first technically described by Linnaeus under the name of *Pediculus bovis*, and evidently the same species is referred to under the name of *Pediculus tauri*. Notwithstanding these descriptions, both of which were under a different genus from that in which it is not placed. The species was again described by Nitzen under the name of *Trichodectes scalaris*, and it has been known by this name in all the numerous writings subsequent to this description. Today this is one of the best known species of parasitic insects.

Description:

This louse is about one-thirteenth of an inch in length and generally the most common on cattle. Unlike the other two, this louse has biting mouth parts and moves about considerably among the hairs.

The head is cone-shaped, rounded at the temples and in front, about as broad at the temples as long. The antennae are inserted well back and are usually directed backward.

The thorax is somewhat covered with short bristles, the first segment being narrower than the second. The legs are slender, the tarsus terminating in a single claw well adapted for clasping and running between the hairs.

The abdomen is elongate, the posterior end fairly rounder. Each segment bears a brown transverse band, otherwise the abdomen is slightly paler than the head and thorax.

As contrasted with the sucking lice, which have a



bluish tint, hence known as "blue lice", this species has a reddish hue and is generally called the little red louse. (Plate IV)

\*Life History:

The eggs hatch in from five to seven days and the period ensuing before the eggs are laid again, is about fourteen days. The eggs are delicate white flask shaped forms having a small cap or lid on one end that is removed when the egg hatches, while the other end is firmly glued to the hair.

Note:

\* G. H. Lamson. "Cattle Lice and Their Control". Bul. 97. Storrs Experiment Station, 1918.

CONTROL

The earlier the treatment for lice the better and more effective the control measures will be. Raw linseed oil is the best and most effective control measure. It is easily applied, and can be done at the rate of five minutes per cow, applications being made at the time of grooming. A good brush to use is one of rice fibers with bristles of unequal length, the end bristles being about one-half inch longer than those in the middle.

If the cattle are treated for lice within the first month after they are removed from pasture, and a definite schedule carried out, lousy cattle will never be a menace to the herd. The first application should be followed with a second one, either twelve or thirteen days later. As the period of incubation of the eggs for all three species of lice ranges between five and nine days, and



the time required to reach maturity is from fourteen to eighteen days, it is self evident then, that in order to kill those lice which were in the egg stage during the first application, a second application is most important. After the second treatment, repeat the application each month during the winter and early spring. Five or six applications a year is sufficient to keep an average herd free from lice.

(Important:) Do not allow the cows to go into the direct sunlight for at least twelve hours after the application has been made. Do not exercise the stock soon after the treatment, nor apply it vigorously, as the skin of the cow is very sensitive to injury.



## CHAPTER III

### The Lice of Horses

Horses, mules, etc., harbor two species of biting lice, *Trichodectes parumpilosus*, and *Trichodectes pilosis*, order (Siphunculata).

Of the Mallophaga, *Trichodectes parumpilosus* is the most common form and according to Piaget is found only upon horses, while the form *Trichodectes pilosis* is reported to have been found on both the horse and the ass. *Haematopinus asini* has also been found on both the horse and the ass. Piaget separates the louse found on the ass in a variety, giving it the name of colarate.

#### The Causes of Infestation.

Like the lice of cattle, these species may spread in much the same way and the conditions regarding the stables, barns, etc. also apply here.

In finding the causes for infection it must always be remembered that the lice of either order, no matter what animal they may infest, are limited to a specific host, which, as a rule, they do not voluntarily leave, unless it is to crawl upon another host, of the same species, or very closely related species. In most cases the migration is ordinarily accomplished when the bodies of the host animals are in contact. Oftentimes, they may spread from one host to another by the changing of the harnesses, blankets, etc., or having fallen upon the stable floor, they may crawl to another host. There are many conceivable means by which lice may spread, but the chief point is that they are permanent parasites and depend-



out upon their host, so that they must either find another host within a limited length of time or perish.

The condition of the skin also plays an important part, and, as with cows, the drier the skin the better the habitat for lice and the better the chances for their multiplication.

As a rule, it has been the writer's experience that colts are more lousy than mature stock. The reason for this is unknown, but a logical answer is that mature stock is very often groomed, and the lice are often brushed off and partly destroyed during the grooming process.

#### The Regions Infested

The sucking lice are usually found at the base of the mane and forelock, and at the base of the tail. They are rather stationary in their habits, generally feeding within the specified areas, and only wander to some extent when they are mature, looking for suitable places to lay their eggs.

The biting lice have been found by the writer to be more common, especially upon colts, although it is generally stated that the sucking lice are more common. In fact, Osborn states that the sucking form, notwithstanding the probable frequent occurrence of this species, he has not been able to meet with it in any abundance. The biting lice, have been secured in great numbers, but just why the sucking form should not be found is unknown.



It is barely probable that examination of mules, asses, or donkeys would show a greater abundance from the fact that horses in general are more carefully groomed than their somewhat despised relatives. The biting lice are often found occupying the regions of the neck, breast, and between the fore and hind leg. They wander more than the sucking lice, and on badly infested animals, have been found practically all parts of the abdomen.

#### The Injury from Horse Lice.

The injury from horse lice is largely one of irritation. The hairs about the badly infested regions are likely to be scant, broken, or the skin entirely denuded, due to the rubbing against anything within reach. During the act of rubbing the animal has a peculiar habit of protruding the upper lip, or, if in reach of another animal, will gently bite it.

The irritation of the itching and rubbing, may lead to the rubbing off of considerable hair and possibly large patches of skin with bleeding and possible sores, which indirectly may prove infectious.

#### The Rise of Infestation.

Ordinarily horses will be more lousy in winter than in the summer, and their presence becomes decidedly manifest in stables towards spring. Horses that are kept in livery stables in cities are apt to be more lousy and show it the year round, than their country cousins, unless they are often



carefully groomed. The reason for this is that the horses in the country have a much larger amount of succulent feed, especially in the summer, when they are turned out to pasture every night. Succulent feeds facilitate the secretions of the skin, therefore making a natural oil which will keep the lice in check so that they are never very numerous.

### 1. Sucking Lice

(*Haematopinus asini*, Linn. (*macrocephalus* Burm))

Siphunculata

Pediculidae.

#### History:-

The sucking horse louse was first figured by Re i and was described by Linnaeus under the name of *Haematopinus asini*. The name evidently implies that his specimens were taken from the ass. Later Burmeister described specimens taken from the horse under the name of *Pediculus macrocephalus*. Denny has taken specimens from both the horse and the ass, from which circumstance he suspected Burmeister's *macrocephalus* to be the same as the Linnaean species. Giebel and Piaget both retain the name given by Burmeister, and Piaget separates as a variety the form occurring on the ass, and gives it the name of *coloreata*.

#### Description:-

The head is long and narrow, the antennae attached to lateral rotubrances, behind which are notches lodging the eyes. Anterior to this, the head is more narrow, with borders parallel terminating in a blunt point.



The thorax is much shorter than the head. The legs are somewhat short and thick, the tarsus terminating in a single claw.

The abdomen is oval, with spiracles placed in the middle of the lateral protuberances on the margins of the segments. The general color is yellowish or rust colored, the thorax brownish. The leathery plates surrounding the spiracles are dark brown.

The female is 5 - 8.5 mm. the male about 2.5 mm. in length. (Plate V.)

Lice History:

The barrel-shaped eggs or "nits" of the sucking lice are deposited on the hairs of the host, close to the skin. The period of incubation covers commonly from five to six days, the young insect on emerging have the general appearance of the adult except for size. Maturity is reached in most cases in from three to four weeks, which accounts for the rapid multiplication of these parasites.

II Biting Lice.

(*Trichodectes pilosus*, Viezel)

Homologae

Philopteridae

History:

The two species of biting lice affecting horses have ever been confusing to many, since there was so much doubt as to the early terminology of these forms, and the lack of proof to know exactly which forms the original references applied to.



To this form, *Trichodectes pilosis*, Linnaeus, in his original reference, had applied the name of *Pediculus equi*, but Piaget has reached the conclusion that this reference is the form subsequently described by Giebel as *Trichodectes pilosis*. It is beyond doubt that Linnaeus in his reference to the lice of horses and asses, refers to the common *Trichodectes* infesting these animals. Denny also described a form as *equi* and which has since almost universally been treated as the Linnaean species, but in reality was a different insect from that described by Linnaeus. Piaget, therefore, describes this form under the name of *parumpilosis*.

It is confusing to get these names straight, but the figures of Piaget leave no question that there is a decided difference between *pilosis* and *parumpilosis*; so if there is no question as to Linnaeus having the form *pilosis* in hand, there certainly are no technical grounds to apply the term *equi* to the common form. In this treatise, therefore, we will introduce descriptions and comparisons of the two forms and adopt, on the authority of Piaget, the names given in his *Les Pediculines*.

*Trichodectes pilosis* is the form originally designated by Linnaeus as *equi*, and which name has been widely used to designate the biting lice of the members of the horse family. The original reference dates back considerably more than a hundred and fifty years, and it is probable that the insect was familiar a long time before that, as the horse and ass were too familiar as domestic animals to allow



the parasites common to them entirely escaping the notice of man.

Description:

This is the smallest of the lice affecting horses. The head is broader than long, rounded in front, and slightly widened at the temples. The antennae are inserted well forward, almost on a line with the heads anterior border, in which respect it markedly differs from *C. parumpilosis*.

The first segment of the thorax is narrow, the second broader but shorter. All the claws are slender.

The abdomen tapers posteriorly and has upon the middle of the first segments darkened spots, less conspicuous than the bands similarly located upon *T. parumpilosis*. The head, thorax, legs and abdomen are hairy on both surfaces. The general color is yellow to a light brown, and the length is 1.5 mm. to 2 mm. (Plate VI.)

(*Trichopteces parumpilosis*, Biaget)

Mallophaga

Philopteridae.

History:

In all probability, this was the form that Denby first described under the name of equi. This is a very common species, and it does not seem possible that the writers previous to Denby should have entirely overlooked the parasite. Nevertheless, Denby seems to be the first one to give it a thorough description and careful drawing.



He speaks of it as common on the horse and ass, but Viaget says he has never found it upon the ass, and there is of course, a possibility that Derny did not distinguish between this and the preceding species.

Description:

The head is decidedly rounded in front, the antennae inserted well back, so that the head forms a full semi-circle in front of the base of the antennae.

The abdomen is more slender and tapering than in scalaris, but less so than in pilosis.

The color is much the same as in the allied species, the head, thorax and legs being a bright reddish brown, or chestnut, and the abdomen of a dusky yellowish color, with eight transverse dusky bands occupying the central or anterior portions of the segments and extending from the middle line a little more than half way to this margin. They are more conspicuous than the spots similarly located on the abdomen of pilosis. (Plate VII.)

Life History:

The life history of both species of biting lice are approximately the same. The eggs or "nits" are deposited by the females and are securely attached to the hairs of the host by means of a gluey secretion. After five to eight days of incubation, the young lice emerge and begin their active life on the host. Their food consists of epidermal scales, bits of hair and exudations from the skin.



In about three to four weeks, they have apparently passed through about five molts and are mature with but little change in form.

Control:

Contagion or pediculosis is due to the rapid succession of generations of lice, their passage from host to host being facilitated by close association, grooming utensils, blankets, harnesses, bedding, etc.

Long "hair, especially if combined with unclean conditions predisposes to lousiness. If in addition there is humidity, the etiologic factors become ideal. Plenty of nutritive food and a thorough cleansing up of animals and their surroundings are, therefore, essential to success, whatever measure of eradication may be applied.

After the removal and burning of litter, the stables may be treated with boiling water and afterward whitewashed or washed with a three to five percent creolin solution. For spraying interiors an emulsion of kerosene according to formulae may be used.

Milk emulsion:- To one part milk add 1 pound of kerosene and churn by a force pump or by other means of agitation. Dilute the resulting emulsion with eight to ten times its bulk of water.

Soap emulsion:- Dissolve one-half a pound of hard soap in one gallon of hot water, or while still at near boiling point, add two gallons of kerosene. Emulsify by use of force pump or other means of agitation. Dilute one part emulsion with eight or ten times part water.



Also a lime-sulphur preparation can be used according to the following formulae.

No. 1      Flowers of sulphur      24 lbs.  
              Unslaked lime          8 "  
              Water                    100 gals.

No. 2      Flowers of sulphur      15 lbs.  
              Unslaked lime          11 "  
              Water                    100 gals.

Clipping the long hair of the animals greatly simplifies their treatment.

Horses may be treated with creolin two or three per cent., or kerosene emulsion. Brushes and combs, after having been disinfected by scalding, may have a little kerosene sprinkled upon them as they are used. Preparations of kerosene should not be applied to sweating animals or while they are exposed to hot sunshine. Friction with fatty substances, as linseed oil, will kill by asphyxia, lice with which it comes in contact. This treatment is more effective if kerosene be shaken up with the oil in the proportion of one of the former to two of the latter. A mixture of kerosene, sulphur, and lead, equal parts, is also quite useful for this purpose.

All measures used for the eradication of lice, whether upon the quarters of bodies of their hosts, should be repeated at least three times at intervals of eight to ten days. This is necessary to destroy the lice which may emerge from remaining eggs.



## CHAPTER IV

The Pork Tapeworm

(Anoplocephala perfoliata, Miltetab.)

A. *anoplocephala*

ediculidae

LITERATURE:

Globon, in his "Travels in Africa to Egypt, Nubia, and the Land of the Pharaohs" (1641, 2 vols.), while stating that he had heard by report of the existence of Anoplocephala (G. 3, 205), which would carry this nomenclature back to the thirteenth century. Parkinson described it under the name of *Cochlearia*, as *Lobula*, which name has been most generally followed, and Johnson retained the name of *urines* and this name has been followed by Globon and L'Herit.

Along with other primitives it received frequent mention by both early and modern writers.

*Haematopinus urinis* is the only species of lice known to infest both the domesticated and wild hog. They are the largest in size of any louse belonging to the Suctorial group and are found wherever hogs are raised. In this country most stock breeders have probably seen instances of this infestation, and from the frequent mention of them in the agricultural papers, it would seem that they were very abundant, and in some cases have multiplied to such an extent as to cause a very noticeable effect on their hosts.

That these lice are not more abundant and not a greater nuisance may be in part, because the majority of hogs are sold and slaughtered at a comparatively early age, and with each one slaughtered, must perish the parasites



colonies to them, unless perchance an occasional individual louse may have escaped the scrubbing trough and had found another out within a limited length of time. In cases where great numbers of hogs are shipped to slaughter houses, it is obvious that here none can beneath the insects they have nourished to their followers.

#### The Damage from Hog Lice.

The fact that hog lice are more commonly found in larger numbers upon poor or runty animals, should not be taken as evidence that the lice prefer such individuals, but rather that the animals upon which they have multiplied so rapidly have, in consequence, become anemic and unthrifty. Just why certain hogs succumb more readily than others is probably due to the lack of natural skin secretions upon such animals.

Since the lice are very active blood suckers, living upon hogs of any age or condition, and found everywhere where these animals are raised, it is quite easy to see, should they multiply very rapidly, the damage they could do to the host.

It is doubtful whether there is any irritation caused by the crawling habits of the louse, since the skin of the hog is not very tender as in the case of the cattle, but that the irritation is caused by the louse piercing the skin with its beak. This is easily proved when a few lice are placed on a clean hog, for when the lice insert their mouth-parts, a sharp, stinging sensation, which irritates the animal, causing it to rub the affected part against fences,



trees and other convenient objects. Very often the hogs rub the affected areas so hard in the attempt to rid themselves of their pests that the skin is torn and scratched, causing the blood to seep out, to which the lice will congregate and apparently feed on the margin.

When hogs are very lousy, they do not do as well as others which are kept free from lice, since the lice feed frequently and suck large quantities of blood which otherwise would go to the building up of the bodies of the hogs. This loss of blood also results in a waste of feed. Also, the continual piercing of the skin worries the hogs and makes them restless.

#### The Regions Infested.

Young lice are frequently found clustered on the inside of the ears of the host, often deep in the inner canal; in the folds of the neck; on the inner side of the legs close to the body; and in other protected places. This condition becomes especially noticeable with the approach of cold weather in the fall, and continues throughout the fall and winter. In cold weather the lice are often clustered on the lower parts of the body, where they are protected and the feeding conditions seem to be ideal. In warm weather they are generally scattered about, although occasionally they will cluster. The older lice are frequently found to seek the warmer parts of the body in cold weather, but do not, as a rule, cluster to the same extent as the younger ones.



The eggs, according to Atts, are attached to the base of the hairs, and while they may be found on almost any part of the host, they majority are found on well-defined areas, which form a broad band running chiefly around the lower parts of the body, including the sides of the neck, the lines of meeting hairs between the neck and the jowl, the breast, arms and foreflanks, the lines of meeting hairs between the sides and the belly, the rear flanks, hocks and twist. They are also found in smaller numbers, on the jowl, shields, lower halves of the sides, and the lower halves of the hems; but only in limited numbers on the upper parts of the body, including the face, ears, top of neck, tops of shoulders, back, loins, hip and rump. They are rarely, if ever, found on the shanks and tail.

#### Description

The head is very long and narrow, cone-shaped, and rounded in front. The mouth is situated on the anterior end of the head and is provided with tiny, sharp, needle-like parts with which the louse pierces the skin of the hog and sucks the blood. These parts are very small and can only be seen with the aid of the microscope. They are kept down into the head except when the louse is feeding.

The thorax is shorter than the head, but much broader. The legs are long and stout, light yellow in color, and marked with several dark areas. Each foot is provided with a long curved, pointed claw. The claw is especially adapted



for clasping and holding the hairs or bristles of the host. Indeed, the louse is able to hold so firmly that it is with difficulty removed from the host, and can cling to the hairs while the animal rubs against fences, posts, trees and other objects.

The abdomen is the largest part of the insect, being about a little over half the total length of the louse. It is composed of several sections, or segments, its margin being notched and bordered with dark colored lines, which are plainly visible. The full grown male and female are easily distinguished by the abdomen. That of the male is nearly rounded, while that of the female besides being much larger is broad near the forepart, and tapers near the rear, so that it has a somewhat pointed appearance. The under surface of the male also has a black streak in the middle of the last three segments which is not found in the female. Plate VIII.

#### \*Life History

The eggs or "Nits" are laid by the full grown females, and are attached to the base of the hairs, especially on certain parts of the body.

The eggs are white when first laid and will remain so unless they become stained with manure, mud or other dirt. They are long and oval, one end being much larger than the other. On the larger end is a round cap, which though not easily seen by the naked eye, is readily distinguished with the aid of a hand lens. The cap itself is the same



color as the rest of the shell, being separated by a fine line running around the end. When an egg hatches, the young louse pushes the cap off and emerges through the hole.

The eggs hatch from thirteen to twenty days after they are laid. They begin hatching on the thirteenth day, only a few hatching at this time; the number rapidly increases until and including the sixteenth day, then rapidly decreases until the end of the twentieth day. Under the natural conditions about fifty percent of the eggs hatch on the fifteenth, sixteenth and seventeen days.

The newly hatched louse is about three sixty-fourths of an inch in length, and is practically the same shape as the full grown louse. It is pale yellow, with brownish mouth-parts and claws.

The young louse becomes very active as soon as it is hatched and begins crawling over the skin of the host searching for a suitable place to feed. When a suitable place has been found the louse inserts its tiny, sharp-mouth-parts and sucks the blood similar to that of the mosquito. It feeds rapidly and in a few minutes becomes well filled with blood, which is easily seen inside its body and appears as a bright red spot in the middle of the abdomen.

The hog louse does not engorge itself, as is the habit of ticks, but feeds frequently. It grows rapidly, molts several times and in from ten to twelve days begins mating.



The female begins to deposit her eggs in eleven to thirteen days, glueing each egg to the base of a hair so that the narrow end almost touches the skin and the blunt end toward the free end of the hair.

The female deposits only one egg at a time, and the entire operations requires but a few seconds, so that one seldom sees a female lay an egg unless watching closely for some time. She usually lays three or four eggs a day, but sometimes as many as five. On hogs that have only a few laid the females seldom lay more than one egg on a hair; but on badly infested animals they lay several eggs on a single hair, on the lower parts of the body, rather than go to other parts where no eggs have been laid.

The eggs can be slipped along the hairs, and are often pulled away from the body by the rubbing of the animals, or are pushed away by the growth of the hairs. This leaves the base of the hairs again free from eggs, and as the older ones are moved away from the body, others are laid in their places, so that eggs are often found closely packed from the base to the end of the hairs. In these cases the eggs next to the body are the newly laid ones, while those toward the end of the hairs are the oldest, the majority of which have hatched. Many of the eggs are rubbed to the end of the hairs, where they finally drop to the ground.



### Duration of Life

Under natural conditions many lice are injured, killed, or lost from the host before they live their full life. Those remaining usually live from fifteen to twenty days after becoming full-grown. The total length of life under natural conditions is about thirty days. A few lice have been found to attain the age of over forty days, but this is exceptional. There are from six to fifteen generations a year, the usual number being from nine to twelve.

### Control

By far the best control measure for killing lice is the application of some thin oil. Linseed oil or crude oil are both inexpensive and easily applied with a brush as described in the control of "Cattle Lice."

In the application of these oils it is important to remember that most of the lice are found on well defined areas so that greater care should be exercised when applying the treatment to these parts.

As with any treatment some eggs or lice will escape the fluid so it is well to make another application twelve days after the first, and a month after the second.

If the above schedule is followed, lice will cease to be a menace to the hogs and should be sufficient to keep the lice in control on any average herd. It is always well, however, to keep a sharp lookout for heavily infested hogs and at any time should the lice become very numerous, another application of oil should be given.



As lice appear in greater numbers during the winter months, the inspections during these months should be more careful.



## CHAPTER V

The Lice of Poultry  
(Bird Lice.)

Besides mammals nearly all birds are infested with feather lice, and some so badly as to suffer very greatly; in extreme cases these parasites may even cause the death of the host. They do not occur indiscriminately, but usually each species is peculiar to a certain species of animal. Sometimes the same species may be found on other than its normal host, and when this occurs it is generally observed that their hosts are nearly related forms, or that they are brought into close contact by their modes of life. On the other hand, the same bird may harbor at the same time a number of different kinds of lice, some of which even show a preference for restricted regions of the bird's body. The bird lice all belong to that order of insects known as Mallophaga. They have biting mouth parts, the principal structure of which are the mandibles. In general shape they closely resemble the sucking lice. The body is flattened, covered with a hard outer chitinous material. The head, is quite large, varying in shape and the antennae are generally inserted on the side, about half way back. The antennae are found to differ greatly in various species, sometimes being different in the male and female of the same species. The antennae may consist of three, four or five segments. Bird lice never suck blood, but naturally



they eat the clotted blood that is found at the edges of wounds or cuts. The eyes are situated on the head posterior to the antennae, and are very conspicuous in some species, while in others they are hardly noticeable. The thorax apparently consists of two segments. The legs are rather stout, and are fitted with two claws (family Liothoidae) and are well adapted for running; the first pair of legs being shortest of the three pair. They never have wings. The largest region of the body is the abdomen, the end of which sometimes differs in the two sexes.

Of the lice infesting poultry, there are at least a dozen species, any of which may co-exist on the same bird.

#### Injury to Poultry

Birds under domestication are particularly prone to lousiness; they are in fact, few fowls entirely free from them. Though, relative to their numbers, lice upon poultry probably do less harm than their blood-sucking relatives, the mites. Their rapid multiplication and the fact that they pass their entire life cycle on their hosts, make it possible for any degree of infestation to become a destructive nuisance in a short time.

The constant annoyance due to their crawling upon the skin and among the feathers, with the energy expended in the efforts to be rid of them, causes fowls to droop and become ready victims to other diseases commonly affecting poultry. The flesh and egg production, under such conditions must necessarily be retarded to such a degree as is commensurate with the infestation.



Young chicks are especially apt to succumb. They give evidence of the presence of lice by drowsiness, refusal to eat, and an emaciated body. The symptoms are generally caused by a loss of feathers, especially about the head and lower part of the neck. Chickens hatched in an incubator should be entirely free from lice, and should remain so, unless they are placed with lousy stock, or put into quarters that have just been vacated by infested fowls.

The head and upper parts of the neck afford a protective location for the lice, as they cannot be reached by the beak. They may, however, especially upon older birds, be found on all parts of the body. In looking for lice on chickens, it will always be wise for one to glance at the vent, as this is another region where lice are apt to be abundant, and can readily be seen by the naked eye.

#### The Large Body Louse.

(*Menopon biserratum*, Biagot)

*Mallophaga*

*Lictheridae*

#### History:

Under the above name Biagot describes a species of louse taken from the *Gallophassa curvieri*, and which he speaks of as occurring also on the domestic fowl, the pheasant and other birds.

It seems very probable that the descriptions of  
Panzer, Hitzsch, Giebel and Biagot all apply to the same insect,  
and if such is the case, it would carry the recognition of



the species back to 1793, when it was described by Panzer under the name of *Pediculus meliagrides*.

Description:

The head is somewhat crescent-shaped, being quite small in comparison with the remainder of the body. The eyes are highly pigmented.

The abdomen is elongate, having two transverse rows of hairs on the first seven segments.

In general outline and color, this species is very much alike to its smaller neighbor, *Xenopon pallidum*. The female is about 2.5 in length. (Plate I.)

\*Life History and Habits:

The eggs are attached securely to the feathers near the body of the host. On young stock or slightly infested fowls, the eggs are more or less scattered with only a few on a feather, while on badly infested stock large masses of eggs, hatched and unhatched, may be found on the feathers below the vent. The first eggs laid on chickens are fastened to the feathers of the back of the head and neck; later the eggs are laid near the vent. The egg is whitish, and elliptical, pointed somewhat like a torpedo, fastened at one end and having near the opposite end a ring of spines. The egg is about one thirty-fifth of an inch in length.

A few eggs on chickens were found to hatch in from five to seven days, the young reaching maturity and laying eggs in somewhat less than seventeen days. This would indicate a life cycle of about three weeks. No doubt vary-



ing temperatures and other conditions tend to modify the lengths of these periods.

This louse is found on certain regions of the hen oftener than on others. On infested chickens it is more abundant under the wings where it finds warmth, but is also abundant around the vent and may be found on the head while the rest of the body is more sparsely infested. The most common area infested on older birds is around the vent, but specimens will be found scattered about the body. It is very active, dodging about and escaping capture with a marked degree of agility. This species, as well as the next, is a body louse for it is rarely found on feathers or any part of the bird except the flesh.

#### The Small Body Louse.

(*Xenopon pallidum*, Hitzsch.)

Mallophaga

Liotheidae.

#### History:

This species is reported by writings to be the most common of the lice infecting poultry, and has been a familiar insect in the writings of entomologists and in the literature of poultry raising.

It was evidently first recognized by Le D. who figured it under the name of *Ulocus capri*. Linneous described it as *Loculus gallinae*, and it is also mentioned by Oskar under the same name. Others described it under the name of *Nimis trigonoculus*, and Hitzsch, recognizing its true generic relations, gave it the name of *Xenopon pallidum*. Denny, Giebel, and Sieget all agree in referring



the figure by Redi to this species.

Description:

The head is somewhat triangular, rounded in front and at the temples. The abdomen of the female is elongated oval in outline; in the male longer and narrower. Each segment on the dorsal side of the abdomen, except the posterior two, is fringed with a single transverse row of hairs.

The legs are stout and hairy, the tarsus terminating in two claws, and being well adapted for rapid locomotion.

The general color is a light yellow and the female measures about 1.5 mm. in length; the male somewhat less. (Plate I).

Life History and Habits:

The general habits of this louse are similar to those of *H. biseptatum*. It is an active body louse, usually more abundant around the vent, and passes through a life history comparable to the species before mentioned.

The Head Louse.

*Liceurus Ioterographus*, Nitzsch)

Mallophaga

Philopteridae.

History:

This species was first recorded by Nitzsch, and appears to be fairly common in the writings of European entomologists. Prof. Osborn believes that Jackard's *Goniocotes burnetti* was described from a female of this species, otherwise it is not very common in American



writings. This may be due to the fact that little attention has been given to collecting these insects here, rather than to their absence.

Description:

The head louse is much darker in color than either of the body lice and is quite easily seen especially if the feathers are white, although it might be mistaken for a bit of earth or other foreign matter on the plumage. The body is edged with dark bands and there are markings of the same shade across the abdomen. The first segments of the antennae of the male are very large and the third segments are branched, while the antennae of the female are slim. This louse averages slightly less than one-tenth of an inch in length. (Figure XI).

\*Life History and Habits:

This louse lives differently from the two previously described, being found upon the feathers and not on the flesh. It is much less active but can easily cli between the barbs of the feathers and disappear from sight. Its feet are better fitted for this work than for running on a plane surface. While usually found near the body it is sometimes seen an inch or two from the base of the feathers. It can live away from the fowl at norm 1 temperatures for a longer period of time than the body lice, probably because it is accustomed to the cooler regions of the feathers. The Head louse does not multiply as rapidly as these other lice. Hens are often found with only a moderate infestation al-

\*Note: G.H.Jackson, Jr. J. Hunter. Some Lice and Flies of the Hen. Bulletin 86, Storrs Agr. Exp. Sta. 1916.



though they may not have been treated for lice for a long time, however, this louse increases very rapidly on chickens.

The eggs are glued to the feathers of the head and neck, being attached to the barbs, often between the shaft and rafter-shaft. Eggs were observed to hatch on chickens; some in four days, others in five, the average being five days. These reached maturity and in turn laid eggs in ten days after hatching. Thus the period from egg to egg would be about fifteen days.

#### Other Less Important Lice.

Besides the three species of lice previously discussed, there are several others of more or less importance, infesting hens. These do not seem to be so widely distributed nor are they so abundant, when found. *Lipourus variabilis* resembles the head louse in a general way with its body smaller and somewhat narrower but marked along the edges and middle of the abdomen in much the same manner. This louse is usually found upon the feathers of the wings. *Goniocotes abdominalis* is a very large species with its head broader than long and its abdomen very robust, and margined by a series of tongue-shaped blackish markings. The length of the body is one-eighth of an inch or slightly longer. *Goniocotes hologaster* is small and rather inconspicuous, being about one twenty-fifth of an inch in length. Its body is round, light in color, and with small markings along the edge. We have found it upon the feathers on the under side of the hen. There are a few other species of



lice that have been collected on hens, but they are not common enough to be of much importance.

Control:

By far, the best control measure for poultry lice is a mixture of mercurial ointment and vaseline. These two ingredients can be had at almost any drug-store, and easily mixed at home. The method is to take one part of the ointment and one or two parts of vaseline, place on a pane of glass and work the two together with a case knife. Precaution should be taken that the two ingredients be mixed thoroughly so that a smooth product is obtained. This should then be placed in a receptacle and labelled. An ounce is usually sufficient to treat about seventy-five birds.

On chickens the best place to apply the ointment is on the body under the wings and around the vent or anus. The efficiency is not so great when placed on the head. The method of application is to take an amount about the size of a pea on the finger and after parting the feathers, rub it on the flesh just below the vent. This will not cover a large area, but it is not necessary to do so. This method has proved successful by reverted tests and has many advantages over other methods. It is often impossible to find a single louse, after birds have been thus treated. The ointment remains effective for a considerable time, so that lice hatching from eggs soon after the treatment are also killed. One application is sufficient to keep chickens



free from lice for several months, but should one want to be doubly sure, another treatment could be given about three weeks after the first. Usually a double treatment is not necessary.

In spite of the care taken to apply the ointment only on the flesh, some of the feathers will also be smeared. These will present a dirty appearance due partly to the ointment and partly to the dirt and dust that sticks to the greasy feathers. Poultry that must be kept clean for show purposes, can be treated for lice by dusting. There are many commercial powders on the market and these can be used on show stock, although the relief obtained by dusting is only temporary. Directions for the application of powders usually accompanies each purchase.

When poultry is infested with the head louse a slightly different line of treatment is necessary.

Blue ointment, lard and vaseline, applied to the head, have been found to be more or less effective. Lard used liberally is perhaps the best remedy, taking into consideration the cheapness, safety, availability and effectiveness.

Best results will be obtained if a second treatment is given in less than two weeks after the first.



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PLATE I

Fig. I Egg of Long-Nosed Cattle Louse. (X20)

Fig. II Egg of Short-Nosed Cattle Louse. (X21)

Fig. III Egg of Hog Louse. (X20)

Fig. IV Eggs of Large Chicken Louse. (X24)

Plate I.



II



III





It is also shown that the effect of the magnetic field on the absorption coefficient is proportional to the square of the magnetic field.

PLATE II

The Short-Nosed Cattle Louse  
(*Haematopinus eurysternus*, Nitzsch)  
Original

Plate II.

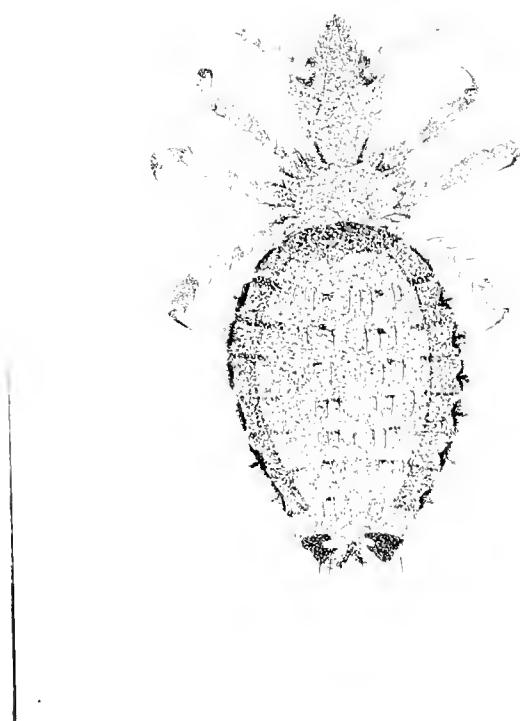






PLATE III

The Long-Nosed Cattle Louse  
(*Haematopinus vituli*, Linn.)  
Original

Plate III.





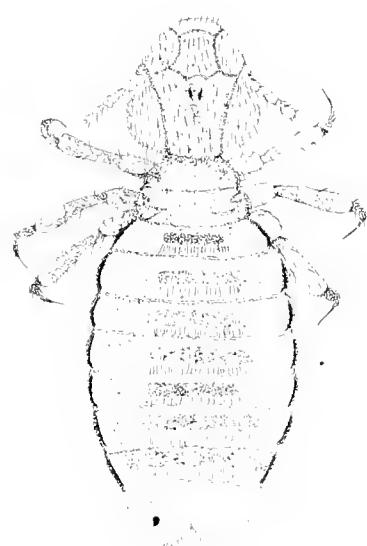


PLATE IV.

The Little Red Cattle Louse  
(*Trichodectes scalaris*, Nitze)  
Original

Plate

IV



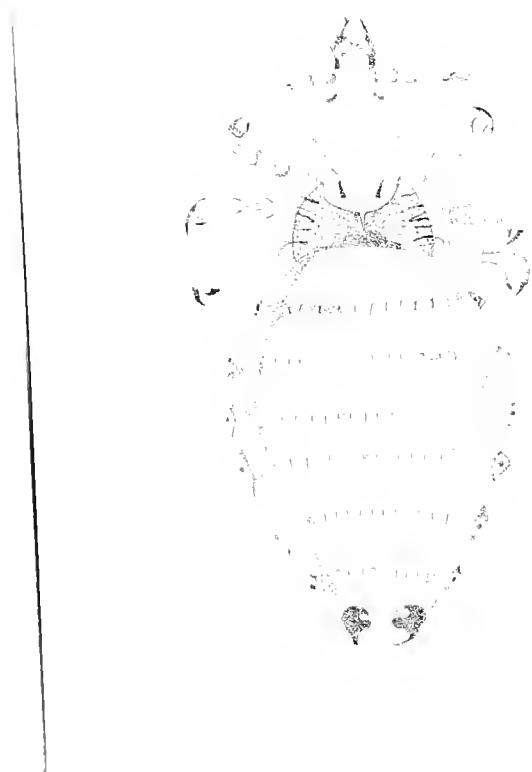




The Sucking Horse Louse  
(Haemotopinus suis, Link)

Medium from piglet.

Plate V







(Trichodectes lincosia, Viebel)

Redrawn from Leppla.

Plate VI.

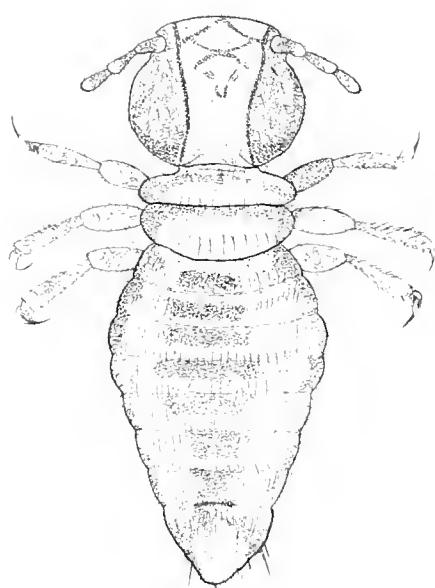
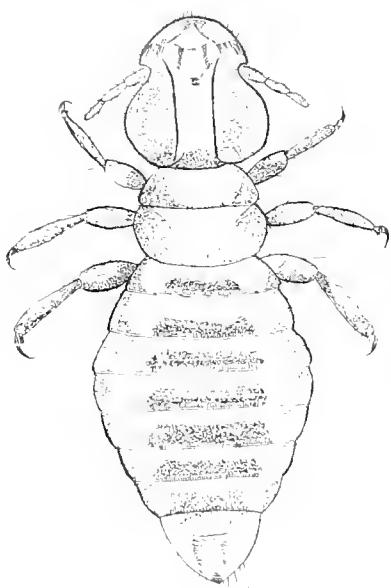






PLATE VII

(*Trichodectes circumflexus*, Biagetti)  
Original







The Hog Tasse  
(*H. chotoensis* Arius, Mitescu)  
original

Plate

VIII







PLATE LX

The Large Body Tōme  
(Menopon biserratum, Tisot)  
Original

Plate

IX







PLATE X

The white Boa Louse  
(*Leptocephalus*, *mitzschii*)  
Original

Plate X





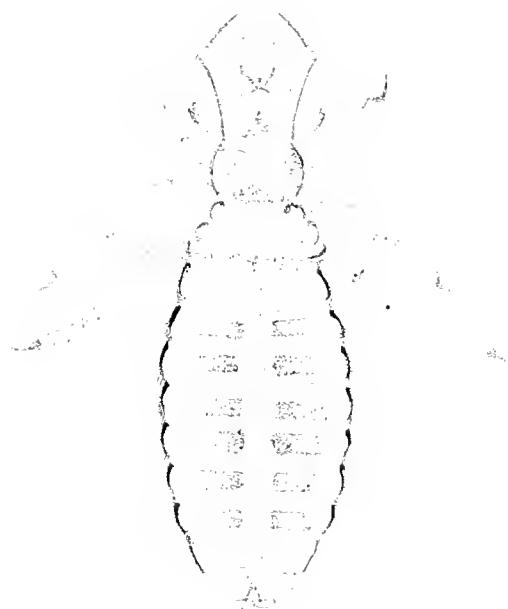


PLATE I

The Head Louse

(*Nitaeurus heterographus*, Nitzaeh)

Plate XI.















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